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POPULATION SIZE, AND FIELD IDENTIFICATION

RICHARD S. PETERSON, CARL L. HUBBS, ROGER L. GENTRY,
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THE GUADALUPE FUR SEAL: HABITAT, BEHAVIOR, POPULATION SIZE, AND FIELD IDENTIFICATION

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ABSTRACT.—Fur seals, *Arctocephalus townsendi* Merriam, 1897, at present land and breed regularly only along the precipitous, rocky east shore of Isla de Guadalupe, 256 km west of Baja California, Mexico. They seldom if ever land on open sandy beaches, and many haul out in caves and recesses along the narrow lava shoreline. The restricted range appears related to the near extermination of the species in the last century. Although congeneric with the fur seals of the Southern Hemisphere, which breed in the austral summer, *A. townsendi* breeds from May to July. Our censuses suggest that the population increased from a few individuals in 1954 to at least 500 in 1967. Form, pelage, vocalizations, certain activities, and habitat provide distinctive features for recognition of *A. townsendi* in the field.

The Guadalupe fur seal (Figs. 5-8) was rediscovered by Bartholomew (1950) in 1949 on San Nicolas Island, California, and by Hubbs (1956a, 1956b) in 1954 on Isla de Guadalupe, Mexico. This paper presents recent information on the habitat and behavior of this seal. Previous reports on *A. townsendi* are those of Scammon (1874) and Townsend (1899); more is known regarding species of *Arctocephalus* of the Southern Hemisphere (Rand, 1967; Vaz-Ferreira, 1956; Paulian, 1964).

The systematic status of the Guadalupe fur seal is far from clear. Judith King (1954) regarded it as identical with *Arctocephalus philippii* (Peters) of Isla Juan Fernández Mas-a-Tierra (in 1966 renamed Isla Robinson Crusoe), off Chile, whereas Sivertsen (1954), the other recent reviewer of the group, treated it as a full, distinct species, and placed both in a separate genus, *Arctophoca*. Scheffer (1958: 78-82) and others have not recognized *Arctophoca* and have compromised by treating *townsendi* as a subspecies of *Arctocephalus philippii*. Preliminary skeletal studies by one of us (Hubbs) seem to substantiate Sivertsen's findings as to differences in skull characters. Provisionally, we recognize the Guadalupe seal as *Arctocephalus townsendi*. Since there are heresay indications that *philippii* may persist on Isla Clara (an islet near Isla Robinson Crusoe), it may yet be possible to compare the populations in detail.

This report is based on observations on Isla Guadalupe, which one of us (Hubbs) has visited repeatedly since he found a small group of fur seals there in November of 1954. All of us visited the island in April and May 1967, on Expedition MV67-I of Scripps Institution of Oceanography, on research vessels "Thomas Washington" and "Ellen B. Scripps." One of us (DeLong) again visited the rookery in October 1967.

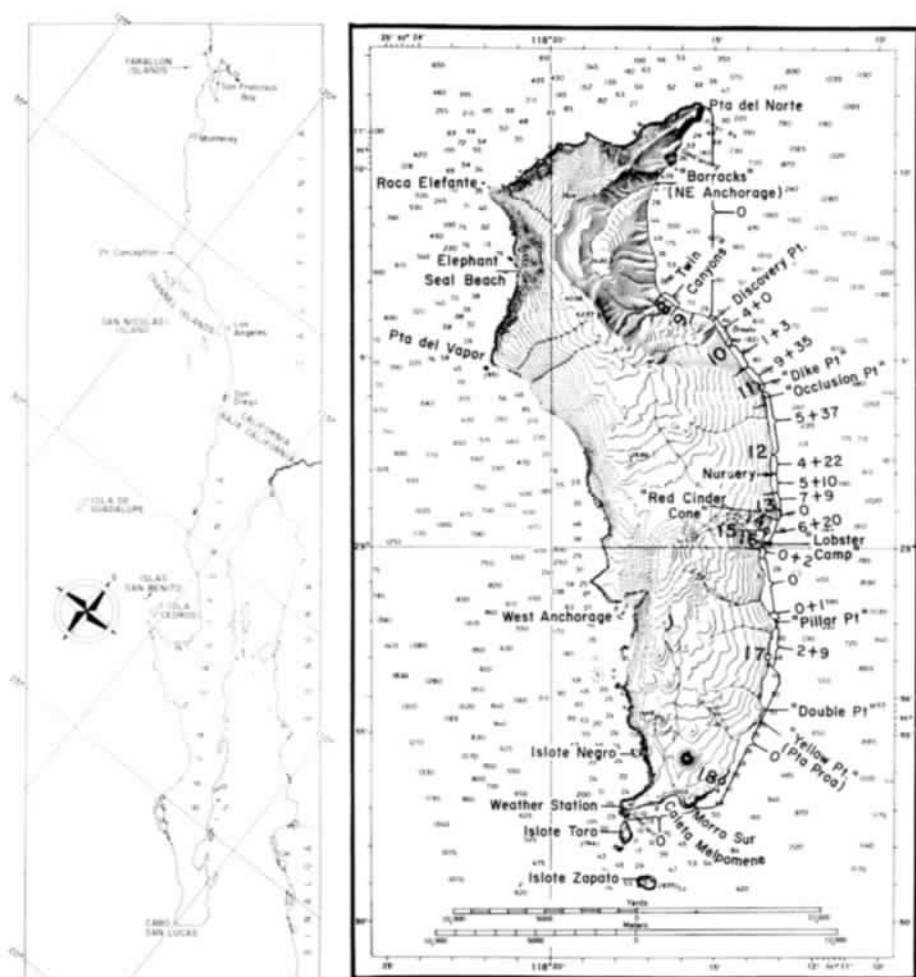


FIG. 1.—Census of *Arctocephalus townsendi* on Isla de Guadalupe, 2–4 May 1967, and map of Pacific coast showing islands mentioned in text. Modified from Hydrographic Office charts 1688E (revised 1965) and 1006. Figures opposite brackets indicate numbers of adult males plus all others. Numbered shore sections after Rice *et al.*, 1965.

HABITAT AND RANGE

Prior to the rapid near-extinction of the species by early sealers, *Arctocephalus townsendi* occurred, presumably in great abundance, on islands off northern Baja California and on the Channel Islands of southern California (Merriam, 1897; Hubbs, 1956a and 1956b), and perhaps on the Farallon Islands off San Francisco (Starks, 1922). Three reports have been published recently of this species on islands other than Guadalupe. Bartholomew (1950) made four definite sightings in 1949 of what was probably a single, lean male on San Nicolas Island, California. Rice *et al.* (1965) reported three individuals

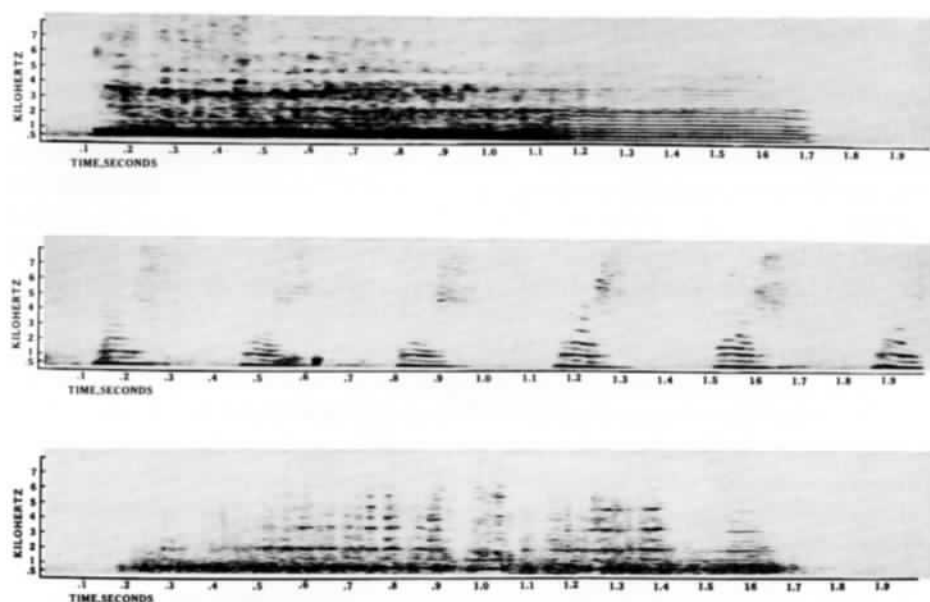


FIG. 2 (upper).—Spectrogram of roar of young male *A. townsendi*. Note that after about 1 sec the call becomes more structured and shows clear harmonics. This is a typical pattern; to the ear the call seems to rise in pitch. Analyzing filter band width, .45 kHz. 3 May 1967, Isla de Guadalupe. FIG. 3 (middle).—Spectrogram of barks or whickers of adult male *A. townsendi*. The high-frequency shadow following each sound was observed in most of the barks that were analyzed. Analyzing filter band width, .45 kHz. 3 May 1967, Isla de Guadalupe. FIG. 4 (lower).—Spectrogram of bawl of adult female *A. townsendi* near a pup. Note the typical pulsing or chopping, contrasted with male's call in Fig. 2. Analyzing filter band width, .45 kHz. 23 October 1967, Isla de Guadalupe.

on Isla Cedros, Baja California. We find no basis for the statement by Bartholomew (1967: 223) that "these fur seals have been seen several times on the San Benitos in recent years."

On Isla de Guadalupe, smoothly polished lava suggests centuries-long occurrence of many fur seals (Bartholomew and Hubbs, 1952: 162). Polished rocks occur along much of the east coast north to Pilot Rock Beach and on the west coast at least as far north as West Anchorage (Fig. 1). At places, the polish extends far above the sea—at one place (on Islote Negro), to an estimated elevation of about 30 m. Also, stone walls dating from nineteenth-century sealing (Hubbs, 1956a), most notably along the east coast near the south end of Isla de Guadalupe, indicate that the fur seals were formerly more widely dispersed around the island than at present.

Fur seals have been observed in recent years (Berdegué, 1956, 1957a, 1957b; Rice *et al.*, 1965) along the base of precipitous cliffs in the median sector of the eastern shore of Guadalupe (Fig. 1). Over the last few years the range has been extending southward. By 1967, the occupied section had expanded to a straight-line distance of 17.4 km, between 28° 56.8' and 29° 06.1' N lat.

Arctocephalus townsendi usually segregates from other species of pinnipeds (Berdegué, 1957a, 1957b). Our April–May 1967 censuses are typical: in the sector described we counted 198 fur seals, but fewer than 350 elephant seals of the total 7648 on the east coast of the island. All of the 747 California sea lions, *Zalophus californianus*, we counted were on Islote Zapato, the outer islet off the south end of the island, far south of the shoreline occupied by the fur seals, and on Pilot Rock Beach, well north of the fur seal area. A similar situation existed during 1–3 April 1966 in that only 212 elephant seals (of 9572) and one California sea lion (of 500) were seen in the area where 372 fur seals were counted.

These segregated distributions illustrate habitat preferences. *Arctocephalus* generally occurs on shores characterized by solid rock and large lava blocks, usually at the base of towering cliffs (Figs. 5–8). *Mirounga* shows prime preference for sandy beaches, although occasionally, perhaps due to population pressure, some occur on cobble and boulder beaches, or even, very rarely, on solid rock. On Isla de Guadalupe *Zalophus* hauls out, almost exclusively, either on the solid bedrock ledges around Islote Zapato, where females and young are included, throughout the year, or on the more sandy section of Pilot Rock Beach, where in recent years increasing numbers, nearly all bulls, have been observed in winter and spring. We have not seen a Guadalupe fur seal on sand or cobbles, except where such material floors a cave or other recess. The steep, shelving shoreline they inhabit is frequently undercut by sea caves, often within lava arches, and there are many passages between and among the loose heaps of lava blocks and boulders (Fig. 5).

In its present secretive behavior and dispersed terrestrial distribution, the Guadalupe fur seal resembles in habits the Galápagos fur seal (G. A. Bartholomew, personal communication), but contrasts strongly with many other pinnipeds. Former rookeries apparently existed on open beaches. It is possible that during the rapid wholesale slaughter of the fur seals a century ago those animals in open rookeries were selectively eliminated. Only a nucleus with secretive behavioral traits may have persisted, thereby modifying the behavior of the surviving population.

Food, predation, interspecific competition, and temperature may also have influenced the habitat preference of the seals. Protection from any considerable interference by man has presumably been of major significance. The lee east side of the island protects the seals from the often violent surf of the west side. Food is not a likely factor, for life abounds all around the island. There appear to have been no terrestrial predators on Isla de Guadalupe (Hanna, 1925). Interspecific competition with *Mirounga* or *Zalophus* appears unlikely. Temperature and shade may have been important, since *Arctocephalus townsendi* breeds during a warm period (May to July) and is heavily insulated. Therefore, cool areas shaded by cliffs and by overhanging rocks, such as are especially characteristic of the present range of the species, may well have been advantageous. Other species of the genus *Arctocephalus*, such as *A. australis* on

Islas de Lobos, Uruguay (Vaz-Ferreira and Palerm, 1961) and on the Galápagos Islands, Ecuador (Eibl-Eibesfeldt, 1960), sometimes haul out in unshaded areas, as *A. townsendi* once did. There are some indications that in such places the animals may protect themselves from extreme heating by keeping intermittently wet in the surf or in tidepools during sunny daylight hours, as do California sea lions (Peterson and Bartholomew, 1967).

Strong site tenacity may account for the restricted habitat of *A. townsendi*. The year-round occupation of the site, as contrasted to the seasonal landing of other pinnipeds, may also have been a factor.

In at least four places near the middle of the area on Guadalupe occupied by fur seals, narrow shelves hold tidepools that the seals frequent. Many juveniles congregate frequently in a group of three connected pools, which we call "The Nursery," adjacent to a major recess in the cliff, at 29° 02.0' N lat.

BEHAVIOR

Perhaps the most unusual feature in the behavior of the Guadalupe fur seal is the tendency to frequent caves and recesses while on land. By looking through vents and windows into these passages, we saw and heard some seals at least 25 m from the cave entrances. This habit, whatever its origin (see previous comments), may well have imposed unusual pressures on social behavior. For example, visual displays may be nearly impossible in dark caves.

Nonreproductive behavior.—In many ways the behavior of nonbreeding Guadalupe fur seals is similar to that of other otariids. At all seasons, play is conspicuous among the young animals. In early May 1967, as on previous occasions, we watched groups of juveniles playing vigorously for long periods in shallow tidepools. They lunge at each other's heads and foreflippers, chase one another in the water, and bark.

A distinctive activity of *A. townsendi* is that of positioning themselves vertically, head-down, in shoal water, while the exposed hind flippers wave slowly in the air. Such behavior is frequent in the Galápagos *Arctocephalus* (George A. Bartholomew, personal communication), and similar activity by *Callorhinus*, but not by *Zalophus*, has been observed.

On shore, Guadalupe fur seals, especially when concealed, commonly allow approach by a human observer. After diving into the sea, the seals almost invariably follow the shoreline closely, often "porpoising." They seldom rear their heads out of the water to scrutinize the observer, as do California sea lions. Adult fur seals in the water behaved aggressively toward a human diver during one of the expeditions (the late Conrad Limbaugh, personal communication).

During the visit by Rice *et al.* (1965: 82) in January 1965, two-thirds of the 285 Guadalupe fur seals on shore were thought to be less than a year old, and a similar proportion has been found during autumn and winter censuses by the Scripps Institution. Nearly all of the 372 animals counted on 2-3 April 1966 were young animals and adult females. On 2-4 May 1967, a majority of the



FIG. 5.—Habitat of *Arctocephalus townsendi*, on east shore of Isla de Guadalupe, with adult male on rock. Photographed by George E. Lindsay, June 1955.

198 animals found were subadults or territorial bulls. Observations on other visits agree in showing marked changes in age and sex composition along shore. During this century Guadalupe fur seals have almost never been found on land elsewhere. Such data suggest that many individuals live pelagically at certain seasons.

Reproductive behavior.—An adequate understanding of reproductive behavior will require observations throughout an entire breeding season. However, our censuses and brief observations, coupled with the early published accounts (Scammon, 1874; Townsend, 1899), leave little doubt that Guadalupe fur seals copulate and give birth in May, June, and July. Almost every territorial bull that we observed in May 1967 was in or near a cave or recess, relatively isolated from other bulls, suggesting that such situations are preferred by the breeding animals. The bulls holding territories were sleek, fat, unmarked by fighting, and reluctant to abandon their territories. In June 1955, one bull (Fig. 6), after having been photographed at close range (Hubbs, 1956a: 18–19) on shore with a single female (Fig. 7), dashed momentarily into the sea, but then promptly returned to land at the same place, despite the continued presence of the photographers.

It appears that females generally aggregate in harems during the breeding season. Our impression is that the harems of *A. townsendi* are more scattered, more loosely organized, and smaller than those of *Callorhinus*. Usually, only



FIG. 6.—Large adult male of *Arctocephalus townsendi* on east shore of Isla de Guadalupe. Photographed by George E. Lindsay, 16 June 1955.

a few females are associated with each bull; 10 is the maximum we have seen. Small harems may reflect the small size of the population.

Vocalization.—The calls of the Guadalupe fur seal are distinctly different from those of *Zalophus* and *Callorhinus* (Peterson and Bartholomew, in press), but are similar to those described by Paulian (1964: 129) for *A. gazella*. Young animals emit at least three distinctly different calls: a *bark*, usually sounded when they move or play; a distinctive, high-pitched *roar* (Fig. 2), which was often directed at us as we approached; and a guttural *cough*, which we heard when animals threatened each other, as when crowded together in a cave.

Adult males on territories seemed to utilize a *bark* (Fig. 3) more often than



FIG. 7.—Adult female of *Arctocephalus townsendi* on east shore of Isla de Guadalupe. Photographed by George E. Lindsay, 16 June 1955.

any other call. When startled by a man, they typically began to utter *roars*, lower in pitch than the roars of the young. When two bulls occupied adjacent caves, we heard a harsh, rasping *puff*, similar to the *boundary puff* with which *Callorhinus* bulls threaten each other at territorial boundaries (Bartholomew, 1953).

Females with pups make a prolonged *bawl* (Fig. 4), apparently during interactions with pups. We have not observed females long enough to catalogue their other vocalizations.

POPULATION SIZE

Recent censuses have indicated that the population has increased since the accounts of the species by Berdegue (1956, 1957a, 1957b), Rice *et al.* (1965), and Lluch and Pilson (1964). Comparable censuses made by walking along the shoreline in February and November of 1964, and in January and March of 1965, yielded totals of 240, 252, 285, and 211, respectively. The greatest number yet counted was 372, on 2–3 April 1966. On 2–4 May 1967, 198 were observed (Fig. 1). None of these censuses was taken in the early summer breeding season, when otariids are generally on land in the largest numbers. To judge from comparisons with other otariids, including other species of *Arctocephalus*, we believe that the total population of fur seals on Isla de Guadalupe is at least



FIG. 8.—Young *Arctocephalus townsendi* on Isla de Guadalupe, 3 May 1967, showing shape of hind flipper and pinna.

500. With continued protection, which we hope may become more rigorous, the species may rise from the "threatened" category.

FIELD IDENTIFICATION

The form of the head and hind flippers, the appearance of the pelage, and vocalizations provide characters that may be useful in distinguishing *A. townsendi* in the field from other otariids in the Northern Hemisphere. The muzzle is narrow, pointed, and upcurved (Fig. 6), especially in adult males, contrasting particularly with *Callorhinus* and *Eumetopias*. Adult males lack the pronounced head crest of *Zalophus*, and the massive head of *Eumetopias*. The flippers of *Arctocephalus* (Fig. 8) are conspicuously larger and the hind flippers are of distinctive shape and have all terminal flaps approximately equal in length, as in *Callorhinus*, whereas in *Zalophus* and *Eumetopias* the hallux is usually conspicuously longer as well as thicker than the other digits. Especially when dry, the pelage has a thick, grizzled appearance quite unlike that produced by the coarser hair of sea lions. As previously noted, there are differences also in behavior.

The bark of *Arctocephalus* is more voiced, more repetitious, and quieter than that of *Zalophus*, higher in pitch and more rapid than that of *Eumetopias*, and more voiced than the panting "whicker" of *Callorhinus*. The prolonged, high-pitched roar (Fig. 2) of young Guadalupe fur seals is distinct from the calls of any other northern otariid.

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Division of Natural Sciences, University of California, Santa Cruz, 95060 (Peterson and Gentry); Scripps Institution of Oceanography, University of California, San Diego, 92037 (Hubbs); and Pacific Program, Smithsonian Institution, U. S. National Museum, Washington, D. C. 20560 (DeLong). Accepted 2 June 1968.